

## 5.0 LOGISTICAL AND METHODOLOGICAL PROBLEMS

1. In this study, we found it difficult to determine precisely where to draw the limits of our investigation. Since the effort put into the investigation is really a function of how much area is to be covered, and not the point A to point B shoreline length, the estimation of areal coverage is critical to level of effort requirements. In the future, study area boundaries for a particular segment need to be more precisely defined. A number of permitted discharges on a particular stream or shoreline segment are quite distant from the actual shoreline and enter the segment via small intermittent stream beds. Another group of permitted discharges were on the segment but beyond the bounds designated for this study. In a comprehensive study of the entire bay system, it would be advantageous to define individual study areas by geographic bounds other than a segment number so that the inputs coming via "drainage ditches" or very small embayments off the main water body would be included. For this study our practical limits for investigating a known permitted site removed from the shoreline was on the order of a mile from the shoreline. In some instances where the discharge feature (pipe or ditch) was evident from the air, unpermitted sites were traced to their origins up to about a mile from the shoreline. Without such an obvious connection to the shoreline, the surveys were limited to approximately 500 meters from the shoreline in the aerial surveys, and basically at the shoreline for the boat surveys.

On a similar vein, the issue of islands, waterways, and other extensions of the shoreline length need to be addressed prior to additional surveys. In this study, East Bay is paralleled by the Intracoastal Waterway. The input of discharges into East Bay via the ICW needs to be addressed; however, its inclusion as part of segment 2423 effectively doubles the length of shoreline to be surveyed.

2. Similar to the preceding, discharge inputs to the water bodies not arising from the shoreline, e.g., petroleum production structures in the bays, need to be more specifically addressed in the scope of work. The effort required to investigate each of these is substantial and not reflective of the shoreline length. In this study, permitted oil structures in the bays were noted but were not investigated or documented. Determining the existence of a discharge from these structures is also a problem, as most discharges would occur underwater and the discharge pipe would be indistinguishable from the supporting structure.
3. The boat surveys need to closely follow the aerial survey for each particular segment or area to be investigated. Much of the insight

gained from the aerial overview is lost if too much time passes or if other aerial surveys are conducted prior to the boat survey. The recommended procedure would be to follow each air survey with a boat survey the next day before proceeding with another aerial survey.

4. It is essential that at least one observer be present on both the aerial and boat surveys for each particular segment. It was found that a single person aerial survey is not a possibility. The preferred staffing would be a pilot/observer who is familiar with the project objectives and procedures and two observers/recorders who would photograph and annotate the charts and logs. Without a pilot versed in the project techniques, an observational crew of three is recommended.
5. The aerial survey proved to be the only way to survey some areas, and was found to be very advantageous in most of the segments surveyed. Some stream segments are too small and shallow to be accessed by boat, and in others, passage was blocked by dams, pipes, and fallen trees. Many shorelines and stream segments are surrounded by private land with no ready access available.
6. The use of Loran C as the positioning location system has some inherent limitations which become apparent when locations as measured in the field are transferred to the topo sheets. The time delays (TDs) are quite reliable in documenting a discharge position; however, the algorithms used to calculate latitude and longitude are not equally accurate throughout the geographic coverage areas. As a result, positional errors in the reported locations of the discharges will appear quite significant when the field recorded positions are plotted on the topo sheets. These errors will vary with the pair of time delays used in the calculation as well as the particular make of Loran unit (and the algorithm it uses). To resolve these apparent positional discrepancies, it is suggested that the TDs be used as the definitive measure of a discharge position until such time as GPS becomes sufficiently dependable and accurate to be the navigational method of choice.
7. Location and positions from the aerial survey were estimated visually with reference to the topo maps. With several areas being inaccessible by boat, we have no measured positional data. For future surveys, an aircraft Loran could be installed in the survey aircraft which would provide this needed information. Units are available which would allow automated data logging via RS232 output to a laptop computer in the aircraft. With this information and adequate aerial photography, more of the boat surveys (performed just to provide latitude and longitude and photographs) could be eliminated.

8. In areas of multiple discharge activity, there was no way to tell from the air or shoreline which discharge belonged to whom. It is recommended, as part of the permitting process and renewals, that discharges be marked at the point of discharge with a placard or sign, similar to those used to note the location and route of pipelines, which would identify by name and number the permit holder.
9. The learning curve both for utilization of the data base program and implementation of the aerial and boat surveys was much higher than expected, and was a greater effort than anticipated at the proposal. In fact, as of the time of preparation of this draft report, we are not as comfortable with handling data in the data base as we would hope to be. Should this project be expanded to encompass the entire Galveston Bay system and beyond, the time needed for familiarization and getting up to speed on techniques and data handling should be a significant factor in the level of effort proposed. For the sake of efficiency in such a comprehensive survey, we would recommend that the project be conducted in its entirety by a single contractor rather than divide it up into smaller segments where the costs of the learning curve will be reiterated with each change in contractor.

There needs to be a clear definition of what constitutes an unpermitted discharge before a comprehensive survey is undertaken. We have reported everything we observed which might be the source of some type of contamination into Galveston Bay. This conservative approach was taken because of a lack of specific criteria or direction in the scope of work to the contrary, and because of the type of reported unpermitted discharges which are reported to the Texas Water Commission. Things such as automotive antifreeze spilled into a roadside ditch, runoff from sawdust piles, and effluents from blocked restaurant drains are representative of the type of reports which are investigated by the Water Commission. Accordingly, we reported any suspect activity or structure. As a consequence of this conservative posture, we have reported numerous structures which may be no more than lawn drains which are to prevent bulkhead collapse on the shorelines. On the other end of that scale, we have reported large discharge pipes which appear to have (or continue to) drained dredged material disposal areas along Cedar and Chocolate Bayous. These may be regulated by Corps of Engineers or EPA permits or they may not fit the criteria for an unpermitted discharge. They are reported as unpermitted nevertheless. However, before a comprehensive survey is to be conducted, or even before these reported unpermitted discharges are investigated, a criteria of what constitutes unpermitted from a regulatory perspective should be established.

10. Consideration (either in method or cost) was not given in the scope of work or in our proposal as to reproduction of maps and photographs required for the documentation in the reports. Map reductions to the size which could be bound in a report would not show sufficient detail to be of value in locating the discharge points. The costs for color xerox to document the unpermitted discharges are approximately \$1.20 per page with two sites per page. We have estimated for future projects that \$100 per report copy be budgeted to cover color xerox of the photographs and reproduction of the maps.
11. The use of key maps (Key Maps, Inc., Houston) proved to be invaluable for pinpointing the location of many permitted discharges as described from the actual permits and also in locating unpermitted discharges where densities were too high and map resolution too low for latitude and longitude to be of value. As an example, street drains can be delineated by description such as "at the end of 10th Street at the intersection of H Avenue".
12. As an aid to locating positions on the myriad of storm and street drains and bulkhead or lawn drains along the western shore of Galveston Bay (or similar shorelines), it would be beneficial for a shorebased observation team to follow the boat survey crew from the highway paralleling the shoreline. Communicating by walkie talkie with the boat, the shore observation crew could document the location of these type discharges by house number or street intersection. They also would be in a better position in some cases to detect the presence of storm drains entering the bay.

## 6.0 RECOMMENDATIONS FOR COMPREHENSIVE SURVEYS

### 6.1 Design

The design of a comprehensive survey for unpermitted discharges should address entire areas surrounding Galveston Bay in order to eliminate the ambiguity and uncertainty of defining the study area. We recommend that such a survey be performed as a single project and not divided into smaller projects to be performed sequentially as funds or interest becomes available. Subsequent to submission of this report in draft form, it was learned that there are other regulatory agencies in the state of Texas which have need of similar information and pursue its acquisition in similar ways. The General Land Office utilizes aerial surveys in keeping track of new construction and the Texas Department of Health has used aerial surveys to locate aggregations of septic tanks which would influence their closure zones for shellfishing. With information and shared need, it would seem advantageous for any subsequent comprehensive survey design to incorporate this need and shared sponsorship.